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(54) DECODING DEVICE FOR ENCODED VIDEO DATA

(57)Abstract:
PURPOSE: To provide the unassumed display function of freeze or the like without increasing the scale of hardware by providing a standard decoding mode for decoding encoded video data based on the information on decoding start time or the like and a special decoding mode for performing decoding without using the information on the decoding start time or the like.
CONSTITUTION: A system purser 2 extracts time information multiplexed to the encoded video dataoutputs the information of the decoding start time or the like to a video data decoding part 5 and outputs video data to a data selection and distribution part 3. A control interface part (I/F) 4 controls the decoding part 5 and the distribution part 3 corresponding to an external command and operates them by a normal decoding operation mode assumed on a code side or the special decoding operation mode of the freeze or the like. By the constitutionthe decoding corresponding to freeze display and the decoding corresponding to high-speed display are performed.

CLAIMS

[Claim(s)]
[Claim 1]A device which decodes encoded video data which carried out multiplex [of

the hour entry at the time of numerals] so that a code amount per [characterized by comprising the following] one picture might not be constant and control of this buffering might be able to coincide by the numerals and decoding side in decoding supposing buffering of data.
A purser means to extract a hour entry at the time of numerals from encoded video data.
A buffering means to buffer before decoding encoded video data.
A decoding means of encoded video data which decodes and displays encoded video data.
A decoding-start-control means to read encoded video data from said buffering meansto supply said decoding meansand to control a start of decodingHave an encoded video data buffer ring monitor means which judges existence of encoded video data in which decoding in said buffering means is possibleand further said decoding meansWhen there is no encoded video data which should be decodedincluding a means on which decoded picture image data already is repeated and displayed said decoding-start-control meansThe first decoding mode a decoding start is made to perform based on decoding time-of-onset information included in a hour entry at the time of said numeralsand second decoding mode a decoding start is made to perform based on a decision result of an encoded video data buffer ring monitor means.

[Claim 2]In said second decoding mode including a means for stopping which said decoding-start-control means chooses some encoded video dataand outputs it to said decoding meansor stops an output to said decoding means of encoded video dataA decoding device of the encoded video data according to claim 1 performing a frieze display by stopping an output to said decoding means of encoded video data by said means for stopping.
[Claim 3]In said second decoding mode including a selecting means which said decoding-start-control means chooses some encoded video dataand is outputted to said decoding meansA decoding device of the encoded video data according to claim 1 performing a high-speed display by outputting some encoded video data with said selected selecting means to said decoding means.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the decoding device which has a function of repeating and displaying the picture image data which decrypted the encoded video data which coded and carried out the data compressionand was

applied to the decoding device to displayespecially was decoded.
[0002]
[Description of the Prior Art]The digitized video signal has the huge amount of informationin record to recording mediasuch as an optical discit is required to be a high speed and large scaleand a very broadband transmission line is needed also in transmission or broadcastand the realization is not easy. Thenhigh efficiency coding of the digitized picture image data is carried outand the coding mode which compresses data volume is used.
[0003]There is an MPEG standard ("Institute of Television Engineers of Japan" it indicates to;Vol.48No.1and pp.44 - 49) which ISO/IEC defines as such a coding mode. In the MPEG standardthe multiplexing method of coding of picture image datathe picture image data which the audio signal coded and codedand voice data is defined.
[0004]In an MPEG standardthe unit of the picture image data which codes is a frame or the fieldand is called a picture. Picture image data takes motion compensation difference between the pictures of before [the]afteror its bothand compression is performed using a discrete cosine transform and variable length coding.
[0005]The picture classified into three coding typesIPand Baccording to the reference method of a motion compensation exists. This is shown in drawing 6. As for the arrow in a figurethe starting point expresses the reference picture and the picture which a terminal point codes. In I picturereference of a picture is not performed and all information required for decryption is coded in the picture (picture inner code-ized picture). While I picture can be decrypted independentlythere are most amounts of transaction datas. P picture uses as an image comparison I picture or P picture decrypted immediately before (forward prediction picture). There are many amounts of transaction datas after I picture. And B picture uses as a reference screen I or P picture which exists in just before and immediately after (bidirectional estimated image). The amount of transaction datas decreases most.
[0006]In an MPEG standardthe data volume generated for every picture as described above differs. In order to make such encoded video data into a fixed bit ratethe buffer memory of encoded video data is made to have in coding equipment and a decoding deviceCoding and decryption are performed so that neither overflow nor underflow may be caused within the limits of the capacity which the buffer memory furthermore defined by the standard. This is explained using drawing 7. A figure is the amount switching model of decode data which shows transition of the data volume inside the buffer memory of a decoding device. A horizontal axis expresses time and a vertical axis expresses data volume.
[0007]Encoded video data is inputted and the data volume inside a buffer increases in connection with it. Once per 1 picture perioddecoding is performed periodically and the data volume in a buffer decreases only the part which is then equivalent to one picture. Since the above is repeatedtransition of the data volume in a buffer becomes the shape of a gear tooth of a sawas shown in the figure. Inclination of the graph at

the time of the increase in data expresses the transmission rate of encoded video data input.
[0008]Supposing the above-mentioned amount switching model of decode datathe peak of data volume exceeds the regulation capacity of a buffer memoryor the coding side controls the numerals yield for every picture so that the minimum of data volume becomes zero conversely and data does not run short.
[0009]In the decoding sideit is indispensable to make the start timing of decoding decode to the timing which the numerals side assumes in the above-mentioned amount switching model of decode data. If earlier than this timingunderflow may ariseand if lateoverflow may occur. In order to make this possibleit is a coding sideand multiplex was carried out to encoded video dataand the hour entry is added. As this hour entryDTS which shows the decoding start time of the encoded video data of PCR (Program Clock Reference) or SCR (System Clock Reference) which shows timeand a picture head (Decoding Time Stamp)And there is PTS (Presentation Time Stamp) which shows the display time of decoded picture datacoincide time with the numerals side by PCR or SCRdecoding is made to start at the time which DTS showsand a display is started at the time which PTS shows.
[0010]By the wayin the device which decodes such encoded video datait is anxious not only for decoding which the coding side assumed but the function to indicate the decoded image by frieze by the middleas what raises user-friendliness.
[0011]About the method for realizing decoding which includes such a function on the other handin an MPEG standard. It recommends decodingafter carrying out the partial change of the contents of encoded video data so that the amount switching model of decode data assumed by the numerals side may be agreed in the amount switching model of decode data which includes the display of a frieze etc.
[0012]Howeverin order to realize thisencoded video data must be analyzedthe device to rewrite must be formed in front of a decoding devicea hardware scale increasesand the problem of causing the rise of cost is produced.
[0013]
[Problem(s) to be Solved by the Invention]The purpose of this invention is to realize the decoding device which realizes display functionssuch as a frieze which is not assumed in codingwithout solving the above-mentioned problem and causing the increase in a hardware scale.
[0014]
[Means for Solving the Problem]In order to solve above-mentioned SUBJECTin this invention A purser means of encoded video dataA buffering meansa decoding meansa decoding-start-control meansand a buffering monitor means of encoded video data are made to haveand a decoding means of picture image data is made to be further equipped with a means on which decoded picture image data already is repeated and displayed.
[0015]

[Function]A purser means extracts the hour entry at the time of the numerals by which multiplex is carried out to encoded video dataand gives informationincluding decoding start time etc.to a decoding-start-control means. A buffering means is stored temporarilybefore decoding encoded video data.
A decoding means decodes the encoded video data read from the buffering meansand outputs display picture data.

[0016]A decoding-start-control means reads encoded video data from a buffering means based on informationincluding said decoding start timesupplies it to a decoding meansand makes decoding start in the first decoding mode. Standard decoding mode in which this performs the same decoding as having assumed in the numerals side is realized.
[0017]A decoding-start-control means reads encoded video data from a buffering means based on the monitored result of a buffering monitor meanssupplies it to a decoding meansand makes decoding start in the second decoding mode. This mode is the special decoding mode in which it can be made to decode without using informationincluding decoding start time etc. For examplein this modethe means on which decoded picture image data is repeated and displayed repeats and displays decoded picture image data to compensate for a decoding stop. Decoding corresponding to a frieze display or a high-speed display is attained by stopping supply to the decoding means of encoded video data intentionallyor making the encoded video data of some pictures skip by this.
[0018]
[Example]An accompanying drawing explains the example of this invention.
[0019]Drawing 1 is a figure showing the decoding device of encoded video data and coded voice data.
1 -- as for a control interface part and 5a system purser part and 3 are [a main memory part and 7] voice data decoding parts a picture-image-data decoding part and 6 a data selection part and 4 a clock generation part and 2.

[0020]Encoded video data and coded voice data go into the system purser part 2 as data_stream multiplexed with the above mentioned timing information. In a system purser partPCR on data_stream or the clock information (PCR/SCR) of SCR is extractedand it sends out to the clock generation part 1. In the clock generation part 1while reproducing the same time (system_clock_time) as the coding side based on this PCR/SCRthe operation clock signal (clock_pulse) of each part is generated. system_time_clock is sent to the picture-image-data decoding part 5 and the voice data decoding part 6and clock_pulse is sent to all the blocks.
[0021]In the system purser part 2distinction (a_v) of data_stream to encoded video dataand coded voice dataIdentify the timing information (DTS/PTS) of decoding and a display startand the coding type information (pic_type) for every picture of an

imageand a_v and pict_typeTo the data distribution part 3DTS/PTS respectively corresponding to the picture-image-data decoding part 5 and the voice data decoding part 7 in DTS/PTS is sent out with data_stream.
[0022]In the data distribution part 3data_sterem inputted via the system purser part 2 a_vWith reference to selction_info inputted from pict_type and the control interface part 4encoded video data (v_stream) is sent out to the picture-image-data decoding part 5and coded voice data (a_stream) is sent out to the voice data decoding part 7.
[0023]An operation command is inputted into the control interface part 4 with the signal shown by command in a figure from the exterior. The picture-image-data decoding part 5 and the voice data decoding part 7 receive supply of State signal vd_req which shows whether a receipt is possible in coding dataand ad_reqand output outside.
[0024]selction_info outputted to the data selection distribution part 4 directs v_stream and a_stream which wish to decode from two or more encoded video data and coded voice data in the usual decoding operation modei.e.the mode in which decoding operation currently assumed by the numerals side is performed.
When data_sterem contains only the encoded video data and coded voice data of a lotselction_info does not have some meanings.

[0025]On the other handin special decoding operation modessuch as a frieze. selction_info bears the information for making v_stream of decoding hope choosestopping the output of v_stream from the data selection distribution part 3and a_streamor carrying out the selected output only of the data of a specific coding type in encoded video data.
[0026]ignore_TS furthermore sent out to the picture-image-data decoding part 5 is an order signal for making the coding data which inputs decoding of encoded video dataand the timing of a display into the picture-image-data decoding part 5 without using above-mentioned DTS/PTS decode as soon as possible.
When special decoding operation mode is directed by commandthe decoding operation which does not use DTS/PTS by ignore_TS is directed.

[0027]The picture-image-data decoding part 5 decodes the encoded video data inputted as v_streamand outputs a video signal (video). By ignore_TSthe decoding operation in this picture-image-data decoding part 5 may be disregarded with the case where it carries out based on DTS/PTSand may be performed. The main memory 6 is used for buffering of the encoded video data which is needed in this decoding processor storing of reference video signal data. It is connected also to the picture-image-data decoding device 5 and the voice data decoding part 7and the memory bus (memory_bus) of the main memory 6 is used for buffering of coded voice dataetc.
[0028]Drawing 2 is a figure showing the details of the picture-image-data decoding

part 5 shown in drawing 1and the main memory 6. 501 by the picture-image-data decoding part 5 A coding data interface circuit502 the purser circuit of encoded video dataand 503 an inverse quantizing circuit and 504 An inverse DCT circuit505 a reference picture-image-data generating circuit and 506 an adder circuit and 507 An output data interface circuitA buffer share control circuit and 509 508 Coding data buffer circuit writingCoding data buffer readout circuitry and 511 510 Forward-addressing picture-image-data readout circuitryBack reference data reading circuits and 513 512 Decoded picture-image-data circuit writing514 is display picture data reading circuitsandas for 61a coding data buffer memoryand 6364 and 65 are frame memories address decode and a data interface circuitand 62 in the main memory 6. Although this figure omits and shows the function in which the main memory 6 buffers coded voice datacoded voice data is little very much compared with encoded video dataand does not affect concrete explanation of this invention.

[0029]Encoded video data (v_stream) is inputted into the coding data interface circuit 501 in the picture-image-data decoding part 5and is written in the coding data buffer memory 61 in the main memory 6 via the coding data buffer circuit writing 509. It is sent out when writing in whether the specific data on v_stream corresponding to DTS/PTS was stored in the address of coding data buffer memory 61 throat to the coding data buffer readout circuitry 510 (DTS-address). PTS is converted into DTSand even if it performs unitary control by DTSin outputting the decoded picture image data (video) and voice data (audio) continuouslyit is satisfactory in any way.

[0030]The coding data buffer readout circuitry 510 manages read-out from the coding data buffer memory 61. To the coding data buffer readout circuitry 510. Above mentioned DTS/PTS (PTS is converted into DTS and treated)ignore_TSsystem_time_clock and DTS_address are inputted and in the mode based on DTS/PTS. When the time which system_clock_time expresses is in agreement with DTS on the occasion of read-out from the coding data buffer memory 61The specific data on v_stream corresponding to this DTS is made to be outputted to the purser circuit 502 of encoded video data from the coding data buffer readout circuitry 510. Read operation is made to maintain as long as that DTS/PTS is disregarded in ignore_TS exists in the coding data buffer memory 61 in the mode in which it is orderedin the state which can decode the data of v_stream.

[0031]The buffer memory share control circuit 508 compares the writing address of the coding data buffer circuit writing 509 with the reading address of the coding data buffer readout circuitry 510When there is room to write in encoded video dataencoded video data is required outside in vd_reqWhen there is no coding data for one picture into the coding data buffer memory 61 in advance of read-out of the encoded video data equivalent to one pictureunder_flow is sent out to the coding data buffer readout circuitry 510 and the display picture data reading circuits 514.

[0032]Encoded video data is sent out to the purser circuit 502 of encoded video data from the coding data buffer readout circuitry 510. In the purser circuit 502 of encoded

video datavariable-length decoding of the data of DCT transformation coefficient dataa motion vectoretc. by which variable length coding was carried out is carried outweighting to DCT transformation coefficient data is performed in the inverse quantizing circuit 503and reverse DCT transformation is further carried out in the inverse DCT circuit 504. This data by which reverse DCT transformation was carried out is data of the pixel level of the image which carried out motion prediction in the coding side.
It adds with the picture image data of a reference screen in the adder circuit 506and the decoded picture image data is obtained.

[0033]The decoded picture image data is written in one of frame memories via the decoding picture-image-data writing circuit 512 among the 1st frame memory 62 - the 3rd frame memory 64. The 1st frame memory 62 and 2nd frame memoryIt is an object for storing of the data henceforth used as picture image data of a reference screenand the picture image data belonging to above mentioned I and P picture is equivalent to thisand the 1st frame memory 62 and 2nd frame memory 63 are used by turns for every I and P picture. In the 1st frame memory 62 and 2nd frame memory 63it becomes back reference picture image data that having been written in previously in time was behind written in as forward-addressing picture image data. On the other handthe 3rd frame memory 64 is exclusively for the picture image data belonging to B picture.
It is used for dividing the picture image data of one picture into the field of two sheets suitable for a display which carried out the interlace when a picture is defined as a frame.

[0034]The picture image data of a reference screen reads said decoded picture image data from the 2nd frame memory 63 from the 1st frame memory 62 in the forward-addressing picture-image-data readout circuitry 511 and the back reference picture-image-data read-out circuit 512One of reference picture image data is chosenor averaging of the two reference picture image data is carried outand the reference picture image data used for a motion compensation is generated in the reference picture-image-data generating circuit 505.
[0035]The display picture data reading circuits 514 read picture image data for the decoded picture image data from either of three frame memories of the 1st frame memory 62 to the 3rd frame memory 64 according to display order. When a picture is defined as a frame at this timeit reads by dividing the picture image data of one picture into the field of two sheets suitable for a display which carried out the interlaceand display picture data (video) is outputted via the video output interface circuitry 507.
[0036]The address decode and the data interface circuit 61 in the main memory 6Via memory_bus which comprises the address and data bus between the picture-image-

data decoding part 5 and the main memory 6receive an address signal and control signalssuch as writing/read-outand this address signal is decodedControl which writes the data on a data bus in a prescribed addressor reads data from a prescribed address on a data bus is performed.
[0037]Drawing 3 shows the example in the usual decoding mode of operation by the amount switching model of decode data. The appearance of display picture data (video) is shown for the situation of the input of the encoded video data input (v_stream) to the picture-image-data decoding part 5 on the amount switching model of decode data under the amount switching model of decode data. IPand B show the coding type of the picture in the figureand the number attached to these shows the row in display order. Although the display of one picture is performed during the 1 picture (a frame or the field) as for display picture datasince the input of encoded video data differs in the data volume generated per one pictureit is inputted at the interval according to data volume. Decoding start timing is a time of an arrow being put downward by a diagram.
Synchronizing with the cycle of a displaydecoding of one picture is performed during the 1 picture.
Although the reduced property to DTS or DTS of PTS directs this decoding start timeit is the requisite that decoding is performed regularly like decoding of one picture during the 1 picture.
For every pictureDTS/PTS is not required and it may not necessarily carry out multiplex onlyfor example to I picture by the coding side.

[0038]Drawing 4 is an example of the decoding operation containing a frieze period. ignore_TS is shown in the top of the figure. Win popularity and rise and further that command of drawing 1 carried out the frieze directions of ignore_TS selection_infoHenceforth [the break of the following picture]the period data selection distribution part 3 which has ignore_TS in a High level stops the output of encoded video data (v_stream). As a resultthe picture-image-data decoding part 5 will be in the state where there is no encoded video data which should be decodedand the display picture data reading circuits 514 of drawing 2under_flow is receivedthe repetition display of the decoded picture image data already stored in the 1st frame memory 62 or 2nd frame memory 63 irrespective of the display time shown by PTS is performedand it shifts to a frieze display. By a diagramit is old in time and the display of the picture of P_1 which moreover has not been displayed is repeated.
[0039]In response to the fact that command pointed to the return from a freeze modeignore_TS returns to a Low level. A return is performed from I51 used as the following I picture. This is because it is suitable for the returnand I picture which does not need the decoding result of the encoded video data lost during the frieze as reference picture image data the data selection distribution part 3Resuming the output of encoded video data (v_stream) from this I picturethe picture-image-data

decoding part 5 resumes decoding to the timing system_time_clock and whose DTS correspond.

[0040]Drawing 5 is an example of the trick reproduction mode which reproduces encoded video data at high speed from a recording mediumand decodes and displays only I and P picture. The encoded video data of B picture is removed by the data selection distribution part 3and fast reproduction is attained by supplying encoded video data to a decoding device at high speed.

[0041]When trick reproduction is directed by commandthe control interface part 4 makes the video decoder section 5 disregard system-time_clock by ignore_TS. The coding data readout circuitry 510 in the image decode part 5If the encoded video data for one frame exists by a diagram in the buffer memory 62 of the encoded video data in the main memory 2 at the middle time of the 1 frame period of a display image at the time which can be decoding starteddecoding is startedand if it does not exist1 frame-period decoding will be stopped. Although the display output of the 0.5 decoded image data is carried out behind time in the example of a figurewhen the stop of decoding occursthe display-image-data readout circuitry 514 receives a under_flow signalrepeats the last display image data and is displayed.

[0042]

[Effect of the Invention]As explained abovein this inventiondecoding based on the hour entry at the time of the numerals by which multiplex was carried out to encoded video dataand decoding which does not use these are attained. In the latter decoding modeby stopping supply to the decoding means of encoded video data especiallyDecoding corresponding to a frieze display is realizablefurthersome encoded video datafor examplethe data of B pictureis skippedand decoding corresponding to a high-speed display can be realized by [to a decoding means] supplying.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]The example of the decoding device of the encoded video data based on this invention.

[Drawing 2]The picture-image-data decoding part in the decoding device of the encoded video data shown in drawing 1and the example of composition of main memory.

[Drawing 3]The amount switching model of decode data in standard decoding mode.

[Drawing 4]The amount switching model of decode data in the decoding mode corresponding to a frieze display.

[Drawing 5]The amount switching model of decode data in the decoding mode corresponding to a high-speed display.

[Drawing 6]The figure explaining a coding mode.

[Drawing 7]The figure explaining the decode data switching model in the coding mode shown in drawing 6.

[Description of Notations]

1 -- Clock generation part

2 -- System purser part

3 -- Data selection distribution part

4 -- Control interface part

5 -- Picture-image-data decoding part

6 -- Main memory

508 -- Buffer share control circuit

510 -- Coding data buffer readout circuitry

502 -- Purser circuit of encoded video data

5140 -- Display-image-data readout circuitry.